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Methods for Estimating the Costs of Soviet
Defense Activities

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MEMORANDUM

Methods for Estimating the Costs of
Soviet Defense Activities

*This memorandum was produced by
Programs Analysis Division of the
Office of Strategic Research and was
not otherwise formally reviewed or
coordinated.*

Preface

This memorandum is intended to provide users of the CIA's annual estimates of the costs of Soviet defense activities with an understanding of how these estimates are derived. It summarizes the sources of information and procedures currently used to develop ruble and dollar measures of investment and operating costs for Soviet military organizations and major weapons systems.

The estimating methods noted are those which were in use on 1 December 1976. These cost estimating methods are continuously being reviewed, however, and will be revised whenever new evidence, new analytical techniques, or the more detailed analysis of available data permit.

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This memorandum does not discuss in detail the processes of calculating the costs of individual military goods or services.

Comments and queries regarding this publication may be
directed to [] the Programs Analysis Division,
[]

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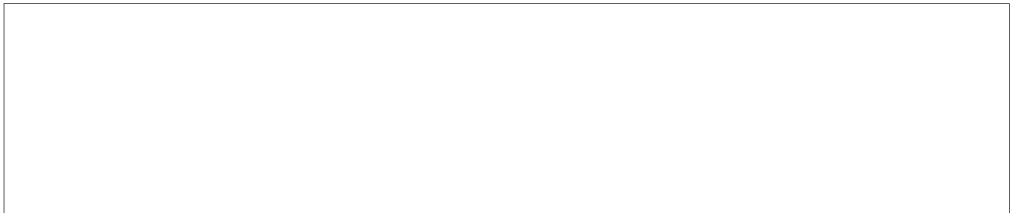
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Graph

Shares of Estimated Costs of Soviet
Defense Programs Included in Major SCAM
Expenditure Accounts. 4

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BACKGROUND

The Direct Costing Approach

Over the past 20 years, the CIA has developed a direct costing, or "building block," system upon which to base the bulk of its cost estimates of Soviet defense activities. This direct costing approach ties cost estimates directly to Soviet military programs and it provides a level of detail not available from other costing methods.

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The direct costing approach begins with the identification and listing of the detailed physical components and activities which make up the Soviet defense effort. These components and activities are then multiplied by appropriate costs and summed to provide annual estimates of the total cost of the Soviet defense program. This total cost is also broken down into various military service, mission, program, or resource categories.

The extensive computation involved is performed within a computer program called the Strategic Cost Analysis Model--SCAM. This program permits the output to be tailored to meet consumer needs. It is also flexible enough to permit analysts to judge the effects that changes in Soviet force structure, military pay, equipment prices, and US inflation exert on the final estimates.

The estimates are developed in both rubles and dollars. Activities included in these estimates are those in the Department of Defense budget and defense programs funded by the Energy Research and Development Agency. Military assistance and civil defense programs are not included.

The dollar cost estimates attempt to reflect how much it would cost in the US to produce and man a military force of the same size and inventory of weapons as that fielded by the Soviets and to operate that force as the Soviets do. They are intended to provide a

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general appreciation of the overall magnitude of Soviet defense activities in US cost terms. The building-block approach permits comparisons with US expenditure data on mission, resource category, and individual program bases.

Dollar costs, of course, do not measure actual Soviet expenditures for defense. Estimates, therefore, are also made in rubles and are an attempt to recreate established Soviet prices. Ruble estimates permit an understanding of the economic and resource considerations underlying Soviet defense planning. They also can give insight into the impact of Soviet defense programs on the Soviet economy. Lastly, these ruble estimates can be used to deduce the priorities of the activities and programs within the Soviet defense budget.

Basic Categories of Costing Data

The Strategic Cost Analysis Model incorporates three basic cost categories--investment, operating, and RDT&E. The investment category includes procurement of weapons and equipment and the construction of facilities. The operating category includes military manpower and activities associated with operating and maintaining the USSR's stocks of weapons and military equipment. The RDT&E category includes Soviet defense-associated research, and weapons system development activities carried out prior to deployment.

These basic cost categories vary widely in their relative contributions to total defense spending estimates.* Ruble estimates of Soviet defense expenditures are affected almost equally by investment and operating expenses, each of which accounts for roughly 40 percent of the total, and least by RDT&E outlays, which comprise about 20 percent of the total. Dollar cost estimates of Soviet military programs are most affected by operating outlays, accounting for over 65 percent of total costs, and are less sensitive to costs of investment or RDT&E, which contribute approximately 25 and 10 percent to the total.

**These comments are based on an analysis of ruble and dollar cost data averaged over the 10-year period from 1967-1976.*

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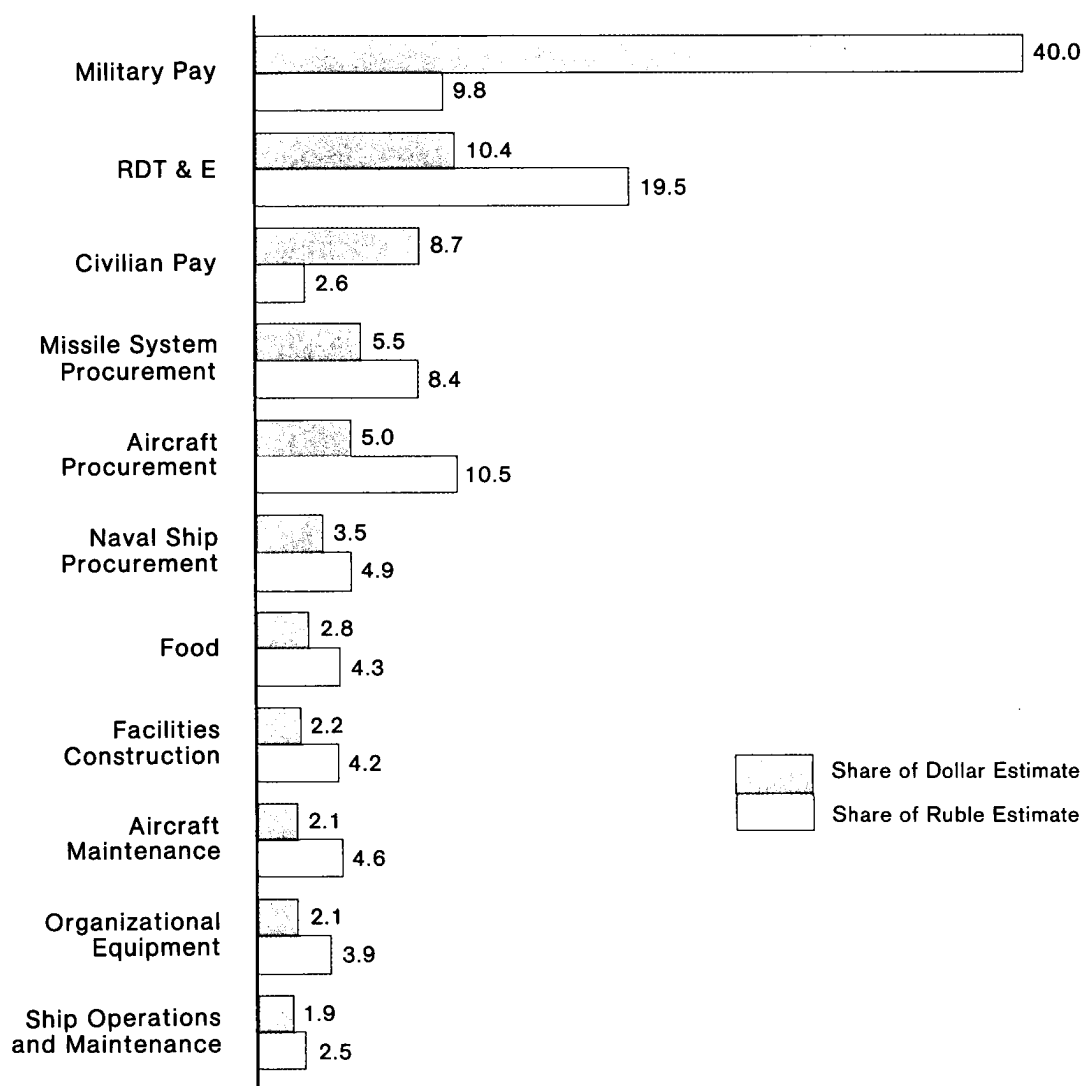
The basic cost categories described above break down into 45 expenditure accounts which are used to catalog inputs to the Strategic Cost Analysis Model in more detail. These in turn are composed of hundreds of individual programs and activities. The graph, next page, illustrates the relative importance of 11 of the SCAM categories which account individually for at least two percent of either the dollar or ruble cost estimates of Soviet defense programs. In combination, these 11 accounts comprise about 80 percent of the USSR's estimated ruble outlays for defense and 80 percent of the total estimated dollar costs of Soviet defense programs.

The difference in relative magnitude of the expenditure accounts is important. In general, therefore, those accounts which have the greatest impact on the total estimate reflect more complex estimating methodologies, while data in the less significant accounts reflect less rigorous cost estimating procedures.

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Figure 1

**Shares of Estimated Costs of Soviet Defense Programs
Included in Major SCAM Expenditure Accounts
(Percent)**



Percentage shares reflect averages for 1967-76. Chart includes all accounts which cover two percent or more of the total cost of the Soviet defense program as estimated in rubles or dollars. The account for clothing and personal equipment—which represents 4.4 percent of the ruble estimate of Soviet defense spending—is excluded because these costs are included elsewhere in the dollar estimate.

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METHODS FOR ESTIMATING INVESTMENT COSTS

Establishing Weapons and Equipment Procurement Rates

Calculations of costs of new weapons and equipment and initial spare parts are made by multiplying estimated procurement rates by unit costs.

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Table 1 illustrates how these procedures are applied to the SCAM investment accounts. It lists the accounts in order of decreasing dollar cost significance and arrays the methods used to estimate procurement rates from left to right in order of decreasing certainty.

Calculating Dollar Costs of Weapons and Equipment

The dollar concept reflects the cost of producing the Soviet design using US production technology, input prices, and profit margins. The ability to reflect the Soviet design depends to a large extent upon knowledge of the physical and performance characteristics of the individual weapons. Where there are good data, the cost estimates capture the austerity or complexity of the Soviet design. When the knowledge is less complete, US analogs are used. In these cases attempts are made to adjust the analog to reflect the general understanding of Soviet design practices.

When there is sufficient information, an engineering cost study is performed. Most of the costs, however, are derived using cost estimating relationships (CERs) which are based on US weapon costs. These costs often are adjusted to "Sovietize" the weapons. Some weapons--usually lower cost items--are costed on the basis of the nearest equivalent US weapon.

These general approaches to dollar cost estimating are used to measure Soviet procurement outlays as indicated in Table 2.

Estimating Ruble Expenditures for Weapons and Equipment

The ruble costs of weapons systems and equipment items are in most cases derived by applying ruble-to-dollar conversion factors to the dollar cost estimates.

Where data are available, conversion factors are developed by comparing samples of Soviet prices with dollar cost estimates. For those defense industries where the available price information is not sufficient to permit direct calculations, ruble-to-dollar factors are extrapolated from those for other defense or civilian industries producing similar products.

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Table 1SOURCES OF DATA FOR DETERMINING PROCUREMENT RATES

<u>Procurement Expenditure Accounts</u>	<u>Production Data</u>	<u>Estimated Soviet Requirements</u>	<u>Other SCAM Accounts</u>	<u>US Analog</u>
Missile Systems				
Ballistic*	X			
ABM, Cruise, SAM, AAM		X		
Aircraft	X			
Ships and Boats	X			
Organizational Equipment				X
Land Arms				
Tanks	X			
Other		X		
Electronics				
Radars	X			
Other		X		
Ammunition			X	
Military Space**	X			
Nuclear Weapons	X			
General Purpose Vehicles		X		
Supplies and Equippage				X

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TABLE 2

APPLICATIONS OF DOLLAR COST ESTIMATING METHODS

	Engineering Analysis	"Sovietized" CERS	"Non- Sovietized" CERS	Combined Costs	US Analog
<u>Missile Systems</u>					
Strategic Ballistic	76*				
ABM			76		71
Tactical Ballistic					65
Cruise			65		60-76
SAM, ASM, AAM	76				
SAM Launchers					60-76
<u>Aircraft</u>					
Airframes	75				
Engines		75			
Avionics	75				
Helicopter Engines			60-75		
Helicopter Airframes			59		
Helicopter Avionics			59	75	
<u>Ships</u>					
Major Surface		74			
Minor Surface				75 (from ruble data)	
Auxiliary				75 (from ruble data)	
Submarine			73		
Electronics and Weapons Systems					73
<u>Organizational Equipment</u>					
Ground and Air Units					75
Other Units					60
<u>Land Arms</u>					
Tanks	73 (T-62)			74	
Combat Vehicles			74		74
Artillery			73		
AA Guns	73 (ZSU)		60		
Rocket Launchers	66 (Tube type)		73		
Small Arms, Mortars					73
<u>Electronics</u>					
Radars			68		
Ground Force Tactical Communications		75			
Comsat and Command Post Systems			72		
Other Electronics					64
<u>Ammunition</u>					
					55-74
<u>Military Space</u>					
Satellites					71-75
Launch Vehicles			66		
<u>Nuclear Weapons</u>					
			73		
<u>General Purpose Vehicles</u>					
					70
<u>Supplies and Equipment</u>					
					75

NOTE: This table provides only a general indicator of the applications of cost estimating methods to SCAM investment categories.

*Numbers indicate the year that the cost estimating methods were developed which are used to calculate costs for the most significant items in each expenditures category.

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Price information is best for Soviet ships. We have a published Soviet costing model which is based on an extensive sample of merchant ship prices from different shipyards in the USSR. We also have ruble price information on Soviet electronics, aircraft, and motor vehicles. Conversion factors for missile and space systems are based on a smaller sample of prices and on extrapolation from the electronics industry. Conversion factors for land arms, ammunition, and organizational equipment are extrapolated from those applicable to tanks and the motor vehicle industry. Ruble prices for nuclear materials are derived from analysis of Soviet production processes and facilities.

Deriving Construction Costs of Facilities

Estimates of Soviet investment in military facilities are made first in rubles and then converted to dollar costs with a ruble-dollar ratio for Soviet construction activities.

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Table 3SIZES OF DATA SAMPLES USED TO ESTIMATE
CONSTRUCTION RATES OF SOVIET MILITARY FACILITIES

<u>Facility Type</u>	<u>Sample Size (percent)</u>
Missile	95 \pm 5
Nuclear Storage	95 \pm 5
Airfield	95 \pm 5
ABM Radar and COMSAT Stations	95 \pm 5
Command and Control	25-50
Naval	5-10
Ground Force	5 or less

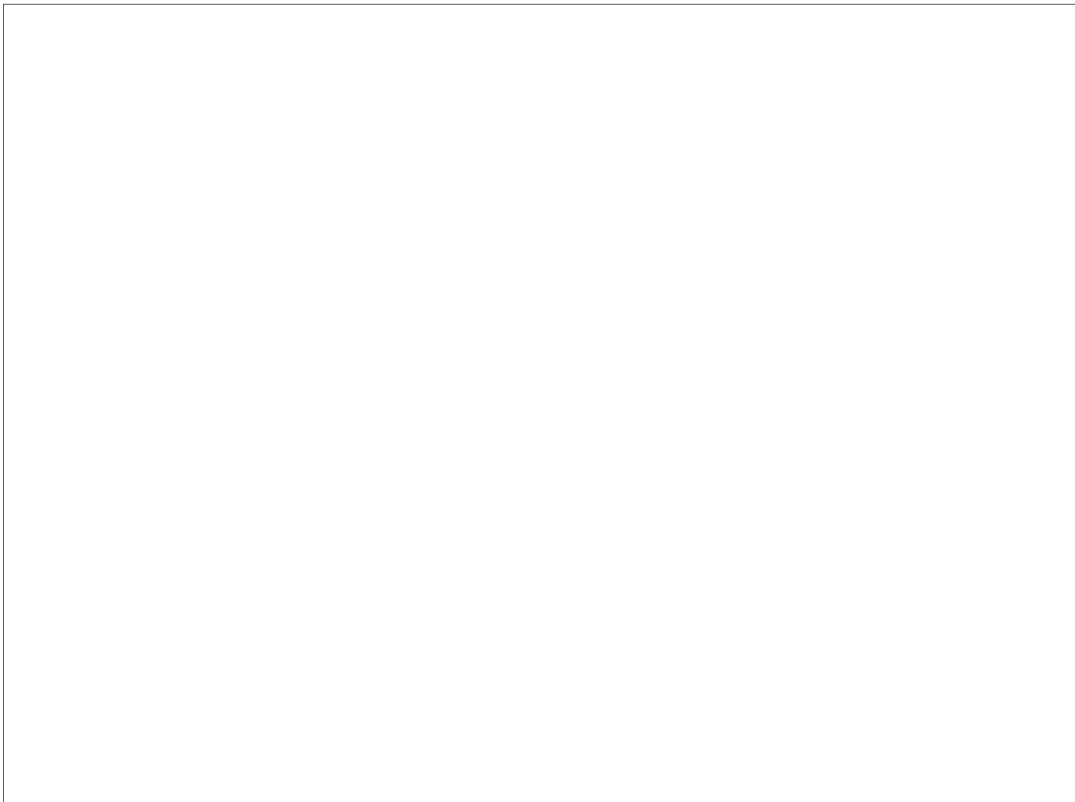
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METHODS FOR ESTIMATING OPERATING EXPENDITURES

Calculating Manpower Costs

Manpower costs are calculated by multiplying estimates of the numbers of men in Soviet military organizations by per-man ruble and dollar cost factors covering each type of personnel-associated outlay. Estimates of manpower levels are made using one of five basic methods:



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The factors used to calculate dollar costs of Soviet personnel expenditures are developed from pay and allowance data for the US armed forces. Average per-man costs for each US military service are calculated and applied to the counterpart Soviet forces. This process imputes the rank structure of the United States armed services to the Soviet military.

The factors used to convert manpower data into ruble expenditures estimates were taken directly [redacted] [redacted] from Soviet publications, or by converting the estimated dollar costs of analogous US personnel expenditures into rubles. [redacted]

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Calculating Operations and Maintenance Costs

Operations and maintenance costs for Soviet systems are calculated primarily by multiplying numbers of weapons systems or the estimated values of equipment stocks by operations and maintenance cost factors. These cost factors reflect the combination of US operations and maintenance cost data and available information on Soviet operating and maintenance procedures. The cost factors applied to order-of-battle data produce dollar cost estimates which are then converted into rubles using generally the same ruble-dollar ratios as are used to estimate procurement costs of the associated equipment. The cost factors which are applied to values of equipment stock or facilities are expressed in percentage terms and provide both ruble and dollar operations and maintenance cost data.

Exceptions to these cost estimating procedures occur when Soviet operations and maintenance costs can more easily be related to manpower levels, or where a direct ruble cost factor is available. The application of these operations and maintenance cost estimating procedures are shown in Table 6.

ESTIMATING RESEARCH, DEVELOPMENT, TEST,
AND EVALUATION EXPENDITURES

Estimates of Soviet RDT&E expenditures are the only ones made by analyzing Soviet financial data, and are of the lowest confidence. These data include published Soviet figures for "science" and capital expenditures, and a total "science and technology" expenditures figure cited in 1975 by the chairman of the USSR's State Committee for Science and Technology. These ruble data are analyzed to eliminate overlaps among the various expenditures accounts and to separate military and civilian RDT&E activities.

Dollar cost estimates of Soviet military RDT&E are made by dividing the ruble costs by a weighted combination of ruble-to-dollar ratios developed for high technology areas such as missile and aircraft production.

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TABLE 6

METHODS FOR ESTIMATING COST OF OPERATIONS AND MAINTENANCE

<u>Expenditure Category</u>	<u>Multiplication of Order-of-Battle Data and Unit Cost Factors</u>	<u>Multiplication of Inventory Values and Percentage Cost Factors</u>	<u>Multiplication of Per-Man Cost Factors and Manpower Data</u>	<u>Application of US and Soviet Cost Data</u>
Civilian Pay			75	
Aircraft	67			
Preinduction Military Training			75	
Ships	75			
Utilities			75	
Land Arms	65			
Missile Systems	76			
Facilities		70		
Petroleum Products				
Aircraft	76			
Ship	75			
General Purpose Vehicles		60		
Military Space Operations*	66			
Electronic Equipment				
ABM, OHD Radars		72		
Air Defense Radars		68		
Other		64		
General Purpose Vehicle Maintenance			60	
Nuclear Weapons Maintenance		72		
Printing and Publishing			60	
Fixed Communications System Leasing				75

NOTE: Dates reflect year of most recent cost factor changes.

*Based on number of launches and US cost factors.

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PRICE BASE

The cost estimates are stated in constant prices to reflect changes in Soviet programs and not the effects of inflation. The ruble estimates are denominated in 1970 established Soviet prices. In the dollar estimates, the base year is moved forward each year using disaggregated price indices.

Personnel cost factors, however, are inserted directly into the dollar estimates each year, using actual base year US costs for such terms as pay and subsistence.